

THE ILIAC EXTRAPERITONEAL OPERATION FOR
STONE IN THE LOWER URETER
IN THE MALE.

BY HARRY ATWOOD FOWLER, M.D.,
OF WASHINGTON, D. C.

DURING the absence of Dr. H. H. Young, of Baltimore, on his vacation in the summer of 1903, the following two cases were referred to me, and form the basis of this communication.

CASE I.—Referred by Dr. H. M. Kaufman, of Washington, D. C., to whom I am also indebted for the following history.

D. R., aged thirty-six years; complaint, attacks of passing bloody urine and constant desire to urinate. The family history is negative.

Previous History.—Unusually healthy, except for trouble for which he seeks relief. He has never had an acute illness or any infectious fevers. He denies all venereal infection. His habits are exceptionally good.

Present Illness.—In 1879, at the age of eleven years, he was taken suddenly, in the morning, with a severe pain in the left side, just under the costal margin. The pain was sharp, cutting in character, and well localized in the left loin. It lasted only a short time. There were no urinary symptoms associated with or following this attack. He did notice, however, a sensation of warmth over an area as large as his hand, situated just below the left costal margin in the left mammillary line. This peculiar sensation has persisted up to the present time.

A few months later, without any pain or other urinary symptoms, he passed a large quantity of blood in the urine. This continued for twenty-four hours, after which the urine became perfectly clear, and there was no disturbance of urination. After this attack of hæmaturia, he was perfectly well for two years.

In 1881, while working on the farm, the hæmaturia again appeared without any warning, persisted for about twenty-four

hours, and passed away, leaving no urinary disturbance. For a period of eight years he was again free from any urinary trouble.

In 1889, while travelling, he had a similar attack of hæmaturia, which lasted about the same length of time, and disappeared again completely.

In 1903 he had his fourth attack of hæmaturia, this time lasting seventy hours. It was directly after this attack that he first noticed any vesical symptoms. There was a constant desire to urinate which lasted for two days, associated with dribbling of urine and pain, which he describes as an uncomfortable burning sensation along the urethra. This gradually passed away in a few days.

Status Presens.—No frequency or other urinary disturbance. Feels well, except for fear of return of hæmaturia and pain.

Examination.—General condition good. Mucous membranes good color. Conjunctivæ clear. No tophi. Chest, clear. Abdomen, negative, except for slight tenderness on deep palpation in the left renal region. Bladder was explored with a Thompson's searcher with negative results. Suspecting a renal or urethral calculus, the patient was referred to me for further examination.

Examination, June 6, 1903. *Urine.*—The urine, voided in three glasses, was examined immediately. Reaction, neutral; specific gravity, 1023; urea, 2.43 per cent. There was no albumen and no sugar. The urine in all three glasses was perfectly clear. The first contained a few shreds, which were found, microscopically, to be made up of mucous threads, together with a few leucocytes. Embedded in the mucus were numerous crystals of calcium oxalate; otherwise the microscopic examination was negative. Palpation of the left kidney region and along the left ureter was not painful.

Rectal.—The prostate was normal, and the microscopic examination of the secretion was negative. Nothing abnormal could be felt above the prostate by bimanual palpation.

Cystoscopic.—Under cocaine anæsthesia, a plain Nitze cystoscope was introduced. A rapid survey of the prostate orifice and the bladder-wall disclosing nothing abnormal, attention was at once directed to the left ureteral orifice. The ureteral papilla on this side was flattened; the ureteral orifice, small, wizened, non-patulous, and appeared to be closed by a plug of mucus. Although

it was watched for several minutes at various times during the examination, no urine was seen to escape from this side.

The right ureteral papilla was very prominent, in marked contrast to the other side. The ureteral opening was large and patulous, and from it jets of urine were ejected with considerable force at intervals more frequent than normal. The associated to-and-fro movement of the trigone was very distinct. The right side of the trigone appeared to be hypertrophied, while the left side was distinctly atrophied. So marked was this contrast in the two sides of the trigone that the provisional diagnosis of a stricture of the left ureter at some point, probably in its lower part, was made.

To clear up the diagnosis, a Casper's catheterizing cystoscope was introduced. After one or two trials, the catheter was engaged and passed easily into the ureter a distance of four centimetres, when it met an impassable obstruction. In the attempt to pass the catheter beyond this point it buckled into the bladder, dragging on the ureteral orifice. The catheter was partly withdrawn and repeated efforts made to pass the obstruction, but without success. The bulging of the catheter into the bladder when the attempt was made to pass it beyond the obstruction was demonstrated to several visiting physicians.

This examination left no doubt as to the presence of a stricture of the ureter four centimetres from its vesical orifice, and, from the history, this was most likely due to a calculus lodged at this point.

The patient was accordingly referred to Dr. Deetjen for radiographs of the left kidney and ureter. Excellent plates were obtained. In the latter plate was to be seen a very distinct shadow in the left pelvic space, at a point corresponding to the obstruction as determined by the catheter. The diagnosis of a calculus impacted in the ureter just above its entrance into the bladder-wall seemed fully justified.

Iliac extraperitoneal ureterolithotomy was performed by Dr. James F. Mitchell, of Washington, assisted by the writer.

Operation, July 29, 1903.—*Left Iliac Extraperitoneal Ureterolithotomy; Suture of Ureter; Iodoform Gauze Drainage.*

An incision, beginning a little inside and above the anterior superior spine of the ilium and extending obliquely forward and downward towards the middle of Poupart's ligament, was made

and rapidly carried down through the muscles. Care was taken to avoid the internal ring. The peritoneum being exposed, it was retracted inward by stripping it up, thus exposing the psoas muscle and the iliac artery. The ureter was at once recognized adhering to the rolled-up peritoneum, from which it was separated by blunt dissection. A small strip of gauze was placed around it for use as a retractor. There seemed to be no dilatation of the ureter, its appearance varying little from the normal. Following it down into the pelvis, a hard nodule was felt lying deep down about one inch above the bladder-wall. Attempts were made to dislodge this upward, but without success. By strong retraction the stone in its deep-lying position in the pelvic ureter was readily exposed without enlarging the incision by a transverse cut across the fibres of the rectus. With good exposure, two mattress sutures of fine silk on a French needle were placed in the ureter, using the stone as a bobbin. Between the sutures so placed a small longitudinal incision into the ureter was made, and the stone easily removed by a pair of mosquito clamps. A ureteral bougie passed without obstruction through the wound into the bladder and upward to the pelvis of the kidney. Having determined the patency of the ureteral canal, the two mattress sutures were tied. It was not found necessary to reinforce them with Lembert sutures. A narrow strip of iodoform gauze to the wound in the ureter was brought out of the lower angle of the wound. The muscles were sutured with buried silver wire, and the skin with subcutaneous silver wire. Silver-foil dressing was used.

Postoperative History.—There was no leakage of the ureteral wound. Slight infection of the drainage canal delayed healing somewhat, but the patient was out of the hospital in four weeks. Recovery was complete. There has been no return of symptoms thirteen months after operation. The patient has been at work steadily since leaving the hospital; his general condition is excellent.

The calculus is small, oval in shape, measuring 1 by .5 centimetre, with a very rough, finely spiculated surface. It is very hard, and belongs undoubtedly to the oxalate of lime group.

CASE II.—H. R., aged thirty-two years; admitted July 18, 1903, complaining of "enlargement of the prostate" and frequent micturition.

Family History negative.

Previous History.—He denies all venereal infection. At the age of ten years, the patient had his first attack of "colic," which he describes as a sharp continuous pain in the right side just below the right costal margin. It was well localized and did not radiate. This attack lasted several hours, and was so severe as to require hypodermics of morphine. These attacks recurred at frequent intervals for about four years; they were similar to the first one, but associated with hæmaturia, which continued for several days. After a period of freedom from the colic for eight years he had in 1893 another attack similar to the previous ones, and associated with bloody urine. Up to this time there had been no other urinary disturbance. Following the severe attack of colic which occurred in 1893, the patient first noticed the symptom for which he now seeks relief. At first the frequency of micturition was only slightly increased. He had to get up once at night to urinate. This gradually grew worse, until the frequency was marked both day and night. There was no pain during micturition, and at no time was blood noticed, although, in 1897, the urine was examined microscopically and was reported to contain blood.

The necessity of passing his water so frequently day and night interfered so much with his rest that he became very nervous and generally broken down. His condition became so distressing, that in 1903 he came from the Southwest to St. Louis for treatment. A physician there told him he had an enlarged prostate; that he would either have to have an operation or wear a retention catheter.

While in St. Louis he had another attack of colic, lasting several hours, and requiring morphine to control the pain. He came on to Baltimore for the operation on the prostate which had been advised. No instruments had ever been passed into the bladder. Attempts to do so had been made, but his urethra was so sensitive that the catheter could not be passed beyond the sphincter, even after the use of cocaine.

Examination.—The patient is very nervous and restless, but otherwise healthy. Examination of chest, negative. There is marked tenderness over the right kidney and, especially, the right ureter. Deep pressure over the latter causes the patient to cry out with pain at the point of pressure and in the penis.

Rectal.—Prostate very tender, otherwise normal. Secretion

normal. Nothing could be felt in the ureters by bimanual palpation. Rectal-examination was very painful, although there were no hæmorrhoids and no fissure.

Urine.—July 18, all three glasses cloudy; specific gravity, 1020; faintly acid. Microscopic: free pus-cells, few red blood-cells, no infection.

July 19, all three glasses clear. Microscopic: occasional leucocyte, no red blood-cells.

This marked difference in the two examinations was due to the fact that at the first visit the urine showed a small amount of blood and pus associated with the attack in St. Louis, while one day later it had completely cleared up.

July 20, the second glass contains a shred which, microscopically, is seen to be made up of mucus in which is embedded a great abundance of calcium oxalate crystals and a few leucocytes.

Cystoscopic Examination.—By using cocaine in the anterior urethra, then passing a catheter and depositing cocaine, 4 per cent., in the posterior urethra and bladder, the cystoscope was passed easily, and the examination was practically painless. No residual urine was found. Bladder capacity, 200 cubic centimetres. Mucous membrane was normal. Just behind the prostate lay a small, irregular mass which looked like a blood-clot and rolled from side to side as the patient was moved. The right ureteral opening was small, slit-like, emitting jets of clear urine at long intervals. There was no marked difference in the two sides of the trigone as in Case I.

The day following the cystoscopic examination, the patient came to the office, assisted by a friend, complaining of severe colic. He was all doubled up with the pain, which was chiefly in the *penis*. Pressure over the kidney and the bladder increased the pain. He would lie on his back, with the thighs strongly flexed on the abdomen, holding on to his penis with both hands, crying out with the severe pain. The next day he had another attack; this time the pain was localized in the right kidney, and was not referred. He urinated frequently, each time passing only a few cubic centimetres, containing red blood-cells and leucocytes in considerable numbers.

He was sent to Dr. Deetjen for radiographs of the right kidney and ureter. The latter plate showed a sharp, well-defined shadow in the course of the right ureter, apparently above the

pelvic brim. Catheterization of the right ureter seemed unnecessary.

Operation, July 29, 1903.—*Extraperitoneal Iliac Ureterolithotomy; Exploration of Entire Length of Ureter and Palpation of Kidney; Suture of the Ureteral Wound with Fine Silk; Small Iodoform Gauze Drain to Ureteral Wound; Heavy Silk Suture of Muscles and Fascia; Subcutaneous Silver-Wire Suture.*

An incision beginning midway between the crest of the ilium and the last rib, and extending obliquely forward and downward just within the anterior superior spine of the ilium was made, and rapidly carried down through the muscles. The peritoneum was stripped back towards the midline, exposing the psoas muscle and the iliac vessels. The ureter, which was slightly larger than normal, was easily recognized adhering to the peritoneum, and had been lifted up with it in the process of stripping it back. The ureter was freed by blunt dissection and a piece of gauze placed around it which was used as a retractor. On account of the apparent position of the calculus as seen in the X-ray plate, the upper part of the ureter was first explored, but nothing was found, although it was carefully palpated up to and including the pelvis of the kidney. Attention was then directed to the lower portion of the ureter, which was exposed by prolonging the skin incision downward towards the middle of Poupart's ligament, care being taken to avoid the inguinal canal. Following the ureter downward, a thickening about two centimetres long was found deep down in the pelvis about one inch above the bladder-wall. Within this thickened portion, which was evidently the result of an old periureteritis, a small, hard nodule could be felt and recognized as a small calculus. After repeated efforts, this was "milked" upward above the pelvic brim. Using it as a bobbin, two mattress sutures of fine silk were placed, care being taken to avoid including too much tissue in the sutures, and thereby producing a stricture when the sutures were tied. The calculus was then easily removed through a small longitudinal incision. A ureteral catheter, introduced through the wound, passed into the bladder and upward to the kidney. There was no stricture of the canal and no other calculi present. The wound in the ureter was then closed by tying the mattress sutures. These were reinforced by a single Lembert suture of the same material. A single strip of wide iodoform gauze was placed over

the incision in the ureter, and the muscle and fascia were then sutured with heavy black silk. The skin incision was closed by a subcutaneous silver-wire suture.

Postoperative History.—There was no leakage of urine. The drain was removed the second day. The wound was entirely healed on the tenth day, when the subcutaneous wire suture was removed. The patient made an uninterrupted recovery. He was up and about the ward in two and a half weeks, and left the hospital on the twenty-fifth day.

Immediately following the operation, the marked frequency of urination subsided. He was able to sleep through the night without having to urinate, and during the day held his urine three hours without any discomfort.

Note, April 18, nine months after the operation. The patient has been working steadily for the past eight months. He has been entirely free from attacks of colic. He does not get up at night to urinate. During the day he can hold his water on an average of three and a half hours.

Urine perfectly clear; acid; specific gravity, 1015; no albumen; no infection. Microscopical examination negative. Bladder capacity is smaller than normal. He complains when 300 cubic centimetres have been introduced, but after dilating the bladder a few times under pressure, 520 cubic centimetres were introduced without causing much pain. The wound is perfectly solid. The patient's general condition is excellent. He says he never felt better.

Remarks.—In these two cases the diagnosis was made and the calculus located before operation by the special methods of examination which we now have at our disposal. In Case I, the ureteral catheter indicated the exact location of the stricture, and the radiograph confirmed the result of this examination, showing a well-defined shadow at the corresponding point in the ureter. In Case II, the ureteral catheter was not used, as the patient was suffering almost constantly from renal colic while under observation, and the nature of the pain, etc., made it very evident that the calculus was low down in the ureter. The radiograph, in this case, showed a well-defined shadow in the course of the ureter, which left no doubt as to the correct

diagnosis. It is to be noted, however, that we were somewhat misled as to the exact location of the calculus. In the radiograph, the shadow appeared *above* the pelvic brim, apparently about the middle of the ureter. At the operation, therefore, this portion of the ureter was first exposed; no stone being found, the upper half of the ureter was next explored with likewise negative results. The calculus was finally detected deep down in the pelvic portion of the ureter, just above the bladder wall. This difference in the position of the calculus, as shown by the radiograph, and as found at the operation, might be due to a change in the position of the calculus after the X-ray examination was made. That such a change of position was possible is evident from the fact that, although the ureter above the stricture was only slightly dilated, the stone was "milked" upwards to a point above the pelvic brim before it was extracted. It is evident, however, that considerable irritation had been caused by the stone in its deep lying position, as there was at this point a distinct thickening of the ureter, due, no doubt, to a periureteritis.

The striking feature in both of these cases was the marked vesical irritability. In Case I, the symptoms were so characteristic of stone in the bladder that this condition was at first suspected and the bladder explored by Thompson's searcher; while in Case II the frequency of urination day and night was a most marked and distressing symptom. It is also interesting to note that this patient presented exquisite tenderness of the whole urethra. The sphincter urethræ was so firmly contracted that it was almost impossible to force an irrigating solution into the bladder, or to pass a catheter beyond the sphincter, except by first instilling cocaine into the anterior urethra. This condition of hyperæsthesia of the urethra has largely disappeared since the operation.

Another striking feature of Case II was the localization of the pain during the attacks of colic. At times the pain was confined to the kidney region, radiating to the back; while at another time it was strictly localized in the penis, the patient

lying on his back, with the thighs strongly flexed on the abdomen, and the penis grasped with both hands.

While ureteral calculi give rise to no localizing symptoms by which we are able to determine from the symptoms alone in what part of the ureter the calculus has been caught in its descent from the kidney, it has been frequently noted that, when the stone lies in the lower portion of the ureter, it gives rise to marked vesical irritability, producing symptoms simulating those of vesical calculus, as in Case I, or marked frequency of urination with or without accompanying pain, as in Case II. In a case reported by Steward,¹ the symptoms were those of stone in the bladder, and, in spite of the negative exploration of the bladder for calculus with a Thompson's searcher (a cystoscopic examination was not made), a supra-pubic cystotomy was performed. The bladder was found free from stone, however, but a calculus was palpated in the right ureter just above its entrance into the bladder-wall. The calculus was removed later by a transperitoneal operation.

In the cases reported by Morgan (Pitt's case),² Bishop,³ Newman,⁴ and Young,⁵ in which the calculus was caught at the vesical orifice of the ureter, the vesical irritation was a marked symptom. In all of these cases the calculus protruded into the bladder cavity, covered only by very thin mucous membrane, as in Pitt's and Newman's cases, or free and uncovered, as in Young's and Bishop's cases. Hence, it is not surprising that the symptoms produced simulated those of vesical calculus, *i.e.*, frequency of micturition associated with pain referred to the glans penis. But, as has already been noted, calculi lodged in the paraischial and juxtavesical portions of the ureter also give rise to bladder irritation, as in the last case reported by Young (*ANNALS OF SURGERY*, 1902, xxxvii), and in Cases I and II above. In the last two cases found in the literature, those reported by Barling,⁶ it is stated that no symptoms were present, which indicated that the calculi had left the kidney; hence, an operation for the removal of stones from the kidney was first undertaken in each case, and it was only by probing the ureters that the calculi were found lying deep down in the

pelvic ureter, just above the bladder, and removed by "milk-ing" upward and extracting through a longitudinal incision higher up in the ureter. Unfortunately, the report of these cases is incomplete. We are not informed as to the presence or absence of bladder symptoms.

I believe that vesical irritation associated with attacks of renal colic suggests strongly that the stone has slipped into the ureter, and has been caught in its descent at a point low down in the pelvic portion.

Calculus of the lower end of the ureter is a rare condition, if we may judge by the number of cases reported. But we suspect the cases are more numerous than these statistics would lead us to believe. Except in those cases in which the stone is caught at the vesical orifice and projects into the bladder cavity, the diagnosis has been made before operation in comparatively few cases.

In the forty-six cases of stone in the ureter collected and tabulated by Morris⁷ in 1899, in but very few was the diagnosis made before operation or autopsy. In the sixteen additional cases reported in his recent work on the kidney and ureter, the same statement is true. If, in the majority of cases, the condition was unrecognized, and if, in a considerable number of cases, calculus of the ureter has been found accidentally at autopsy, no symptoms having been present leading to a suspicion of their presence, it may be asked, How many cases go unrecognized altogether? There can be little doubt that this number has been large.

The improved methods of diagnosis enable us at the present time to recognize these cases with greater ease, and in a certain percentage of cases to determine the exact point of impaction. The condition can be recognized before the kidney has become disorganized, or the patient's life is jeopardized by such complications as pyonephrosis and calculous anuria, or made almost unbearable by years of torturing pain; and the question of early diagnosis is one of considerable importance. Although, as has been pointed out, a patient may carry a stone in the ureter for years without suffering with the usual attacks

of renal colic, or presenting any symptoms indicating its presence, and without showing any evidence of that slow, but progressive, destruction of the kidney often associated with this condition, yet such cases are unusual, and one can never say, in any given case, just what course matters will take. In this respect the condition is similar to that of inflammation of the appendix.

If a stone has remained impacted in the ureter for any considerable length of time, the chances of its being finally passed into the bladder are remote; and to leave it undisturbed is dangerous.

Young,⁵ in his report in 1903, collected from the literature eighteen cases of stone impacted in the lower end of the ureter in the male which have been operated upon. To this number may be added another case operated upon by Young and included in a later report, two cases reported by Barling, and one reported by Steward in 1901 and overlooked in the above collection, and the two cases here reported, making twenty-four cases in all to date.

These cases are grouped, according to the operation, in the following table.

| Operation. | Number. | Recovered. | Died. | Not Stated. |
|--------------------------------|---------|------------|-------|-------------|
| 1. Intravesical | 9 | 6 | .. | 3 |
| Suprapubic cystotomy | 6 | 4 | .. | 2 |
| Catheter cystoscope | 1 | 1 | .. | .. |
| Lithotrite | 1 | 1 | .. | .. |
| Perineal urethrotomy * | .. | .. | .. | 1 |
| 2. Percutaneous | 1 | 1 | .. | .. |
| 3. Intraurethral | 1 | .. | 1 | .. |
| 4. Transperitoneal | 1 | 1 | .. | .. |
| 5. Iliac extraperitoneal | 12 | 10 | 2 | .. |
| Totals | 24 | 18 | 3 | 3 |

* Morris, in his work referred to above, p. 473, says: "The perineal incision is said to have been practised by Desault and Garengot." In his interesting work, "*Traite des Maladies des voies urinaires*," Desault reviews the methods then in use for removing calculi impacted in the ureter at its vesical orifice. These he considered inadequate. He described a new operation and devised a new instrument, which he called a "*coupe-bride*," for use in these cases. Unfortunately, no diagram of this instrument is

The technique of the operation is as follows:

A perineal cystotomy was first performed. The finger was then introduced into the bladder in order to locate the stone caught at the vesical orifice of the ureter and exposed within the bladder. With the stone thus located, the coupe-bride was then introduced into the bladder through the wound, and the collar about the calculus, formed by the folds of mucous membrane, was engaged within the jaws of the instrument. This collar is then cut by sliding the blade of the instrument within its sheath. If the collar tissue is not prominent enough, or the beak of the instrument cannot be engaged between it and the stone, it was advised to grasp the tumor formed by the stone, within the jaws of the instrument and to cut the envelope thus fixed. One can increase at will the size of the incision. This procedure allows the stone to fall into the bladder, and it is then extracted in the usual way.

Although no cases are reported, this operation was apparently performed, and was considered by Bichat very much superior to the methods then in use.

There seems to be a wide divergence of opinion among operators as to the best method of attacking a stone lodged in this portion of the ureter. But, as our experience with this condition increases, there can be little doubt that a more uniform method of procedure will be adopted, and many of the operations which have been suggested or actually carried out will cease to have other than historic interest. The intrarectal route, which was employed in only one case,⁸ and followed by a fatal result, has nothing to recommend it.

The perineal route, employed by Fenwick⁹ in one case, has the great objection that it does not permit exploration of the ureter and kidney. In addition, the technical difficulties of the operation are such as to require very urgent indications for interference before one would be willing to undertake this operation.

given. From the description of the technique, however, one gets the impression that the coupe-bride was not unlike the Bottini instrument in its principle of construction.

In 1892, Cabot¹⁰ suggested removing the calculus through a modified Kraske incision. In a recent article on "Calculus Anuria," he refers to this as follows: "This lowermost part of the ureter in the male is more difficult of access. The writer, in the article above alluded to, pointed out the fact that this portion of the canal could be reached extraperitoneally by a Kraske incision with removal or displacement of part of the sacrum." This sacral route has never been employed in the male. Morris, in his "Surgery of the Ureter and Kidney," records two cases, both female, operated on in 1900 by a modification of the sacral route. Cabot concludes his recent article as follows: "In some cases, the aid of the hand within the abdomen may enable us to remove a stone deep in the pelvis, through an extraperitoneal incision." It seems to us that the sacral route is not only unnecessarily severe and destructive, but is open to the same objection as that urged against the perineal operation, namely, that it does not permit thorough exploration of ureter and kidney. In every case of ureteral calculus, the ureter, above and below the site of impaction, should be thoroughly explored by bougies to determine the patency of the canal. Stricture of the ureter below the calculus is not infrequently found. This may be the chief factor determining the point at which the stone is arrested in its descent from the kidney, or it may result from the inflammatory changes produced by the foreign body within the canal. In every case a thorough examination should be made, and, if a stricture be present, it should be dilated by suitable means. Without giving careful attention to this important detail of any operation for the removal of ureteral calculi, we can expect only a greater percentage of recurrences, since one of the causes which leads to this condition has not been removed. In the earlier operations for stone in the kidney, the possibility of a stone in the ureter was overlooked, and in many a persistence of the symptoms necessitated a second operation. At present, no operator considers a nephrolithotomy complete and thorough without a careful examination of the ureter to insure its patency and freedom from calculi. It is quite as unpar-

donable to close a ureterotomy incision before a careful examination of the entire length of the ureter and the kidney pelvis has been made in order to determine the presence of other calculi or a stricture at some point in the canal.

The transperitoneal route has been employed but once in the male for a stone in the pelvic portion of the ureter. This case, reported by Steward, 1901, may be briefly summarized.

Man, twenty-four years, suffered three years from attacks of painful micturition, associated with hæmaturia. At time of operation, the urine contained considerable blood and pus. No pain, tenderness, or fulness over either kidney or ureter. The bladder was sounded with negative result, and two radiographs showed nothing abnormal. Nevertheless, the symptoms were so characteristic of vesical calculus that the diagnosis of encysted calculus of the bladder was made and a suprapubic cystostomy performed. The bladder was free, but a stone was felt in the right ureter at a point two inches above its vesical orifice. The suprapubic wound was closed, and, nine days later, an incision was made in the lower right linea semilunaris, and the abdomen opened. The stone was located and pushed up to a point just above the common iliac artery. The ureter was then incised and the stone removed. The incision in the ureter was closed with a continuous suture of fine silk, and the peritoneum was sewn over it. The calculus, cylindrical in shape, measured one-half by one-third inches, and weighed nine grains.

The good result in this case depended on the fact that there was no leakage from the ureteral incision. But one can never be sure in any case that leakage will not occur, even when the stone is dislodged from the point of impaction upward to a point where the sutures can be more easily and accurately placed, and the tissues of the ureteral wall are not damaged. If the urine be infected, as is not infrequently the case, the danger of infection of the peritoneal cavity is well-nigh unavoidable. This accident occurred in one of the three cases in which this operation was employed in the female, the patient dying of peritonitis. Morris says it is safer to remove the stone by an extraperitoneal rather than a transperitoneal operation, even when its existence and location have been determined by an intraperitoneal search.

These various operative procedures for the relief of this condition in the male represent various stages in the develop-

ment of our technique. When it is considered that, no longer ago than 1898, the pelvic portion of the ureter was held to be inaccessible, we can appreciate the rapid strides which have been made in the surgery of this region.

The iliac extraperitoneal route is generally held to be the best method of reaching and extracting calculi from the upper three-fourths of the ureter. As long ago as 1882 Bardenheuer operated in this way, and since then the method has become generally used. It seems to have been taken for granted, however, that the lower portion of the ureter is inaccessible through this incision. But a reference to the table here given shows that calculi impacted in this portion of the canal have been removed in twelve cases by eight operators.

In a large number of cases, it has been found possible, after exposing the ureter and locating the stone, to dislodge it upward and remove it through an incision higher up where the ureter is not so likely to be damaged and, for that reason, leakage is less likely to result.

In Case I, reported above, the stone was impacted at a point one inch above the bladder-wall. It was found impossible to dislodge it upward. An incision into the ureter was made over the stone at the point of impaction, the stone removed, the ureter explored, and the wound closed with two mattress sutures of fine silk. There was no leakage.

Furthermore, Young (Case I), after removing a calculus lodged in this situation, found, on examination, a tight stricture below the stone, one centimetre from the vesical orifice, which could not be dilated by bougies. Through the same incision, the bladder was drawn over and an incision made into its lateral aspect, through which the ureteral orifice was exposed and the stricture cut intravesically. This procedure is graphically shown by drawings accompanying his article in *ANNALS OF SURGERY*, Vol. xxxvii.

These cases show conclusively that this portion of the ureter is as freely accessible by means of the iliac extraperitoneal route as is the upper portion. They show that the ureter can be explored throughout its whole extent, down to

the bladder-wall; that the stones in the lower part may be either dislodged upward and extracted at a higher point, or removed by incision of the ureter at the point of arrest, and the wound sutured. Finally, these cases show that when there is present a stricture in the intramural portion of the ureter, the bladder may be incised, and the necessary additional procedures carried out, without making a separate suprapubic incision.

Extraperitoneal ureterolithotomy is a highly successful operation. The mortality should be even less than that for nephrolithotomy. And with an operation combining such small risk, with so great technical simplicity, this part of the urinary apparatus will be as fearlessly and as successfully exposed as the other portions which have long been considered more easily accessible.

The intravesical portion of the ureter is most readily and most satisfactorily reached by suprapubic cystotomy. This gives the best exposure; the operation on the ureter can be carried out under guidance of the eye.

Calculi in the intravesical or intramural portions of the ureter then are best reached by the suprapubic intravesical route; calculi impacted in the juxtavesical and paraischial portions should be removed by the iliac extraperitoneal route.

BIBLIOGRAPHY.

- ¹ Steward. *Lancet*, 1901, i, p. 1142.
- ² Morgan. *Lancet*, 1898, i, p. 560.
- ³ Bishop. *Edinburgh Medical Journal*, 1900, Vol. i, p. 47.
- ⁴ Newman. *British Medical Journal*, 1903, ii, p. 949.
- ⁵ Young. *American Medicine*, Vol. iv, No. 6, pp. 209-17.
- ⁶ Barling. *British Medical Journal*, 1903, ii, p. 1532.
- ⁷ Morris. *Lancet*, December 16, 1899.
- ⁸ Ceci. *La Reforma Medica*, September 5, 1887, p. 1214.
- ⁹ Ferriewick. *Edinburgh Medical Journal*, 1898, p. 281.
- ¹⁰ Calot. *American Journal of Medical Sciences*, 1892, p. 43.

TABLE INCLUDING THE CASES OF STONE IMPACTED IN LOWER END OF THE URETER IN THE MALE WHICH HAVE BEEN OPERATED UPON, ARRANGED WITH REFERENCE TO THE OPERATION.

| Reported by | Age. | Duration. | Side. | Prominent Symptoms. | Number. | Position. | Result. | Remarks. |
|-------------------|--------------|------------------|-----------------|--|---|---|---------------------------|--|
| (A) 1. Ceci. | (?) | Several years. | Right and left. | Symptoms of ureteral calculus. | Several removed from left ureter. | Juxtavesical. | Died in thirty-six hours. | Calculi also present in right ureter. |
| (B) 2. Fenwick. | 18 | Eighteen months. | Right. | Hæmaturia. Pain in glans after micturition. Lumbar pains. | One, size of small peach-stone. | Juxtavesical (?). | Recovery. | Cystoscope showed prolapse and villous tuft, which were removed by suprapubic cystotomy. |
| (C) 3. Young. | 31 | Seven years. | Left. | Colic. Constant desire to urinate, with pain in glans penis. | One 6 mm. in diameter, 3 mm. thick. Rough and spiculated. | Protruding into vesical cavity. Uncovered by mucous membrane. | Immediate recovery. | Left testicle markedly retracted. |
| (D) 4. Freyer. | 53 | Several years. | Right. | Frequency of micturition. Pain in glans. Hæmaturia. | One. | Intravesical. | Recovery. | Patient had urethral stricture. Negative exploration of kidney. Stone projecting from ureter detected by cystoscope. |
| (E) 5. Steward. | 24 | Three years. | Right. | Painful micturition. Hæmaturia. | One. | Two inches above vesical orifice. | Recovery. | Diagnosis of encysted calculus of bladder. Condition recognized by suprapubic cystotomy. |
| (F) 6. Helfrichs. | Elderly man. | Three years. | Left. | Lumbar pain. | One, 2 x 5 cm. | Intravesical, projecting into bladder. | Recovery. | Large vesical calculus removed by suprapubic cystotomy. Patient died eight months later. |
| 7. Pitts's Case. | 9 | | Right. | Vesical calculus. | One, ½ inch long. | Intravesical, covered by mucous membrane. | Recovery in six weeks. | Stricture of vesical orifice of ureter. Vesical calculus size of plum-stone removed. Ureter divided, and stone extracted with a probe with pressure by finger in rectum. |
| 8. Bishop. | 13 | "Long time." | Right. | Vesical calculus. | One, 1 inch long. | Protruding into bladder. | Recovery in two months. | |
| 9. Bishop. | 8 | Eight days. | Right. | Vesical calculus. Colic. | One. | Intravesical. | Recovery. | Vesical calculus removed eight days before. |

| No. | Name. | Sex. | Age. | Side. | Intermittent colic. Frequent mictu- rition. | One, size of cherry. | Intravesical, cov- ered by thin, vascular mucous membrane. | Not stated. | Thought to be fibroma, and re- moved by vulsellum forceps. |
|-----|----------|-------|------|--------|--|--|---|----------------|--|
| 10. | Newman. | Male. | 35 | Right. | Intermittent colic. Frequent mictu- rition. | One, size of cherry. | Intravesical, cov- ered by thin, vascular mucous membrane. | Not stated. | Thought to be fibroma, and re- moved by vulsellum forceps. |
| 11. | Newman. | Male. | 54 | Right. | Vesical calculus. No renal symp- toms. | One, small red cherry. | Intravesical. | Not stated. | Vesical calculus, phosphatic, be- hind enlarged middle lobe of prostate. Removed by vul- sellum forceps. Ureter sutured. |
| 12. | Twynham. | Male. | 8 | Right. | Abdominal pain. | One. | Near vesical end. | Recovery. | Catgut closure. |
| 13. | Morison. | Male. | 46 | Right. | Haematuria. Patient in uremic coma. | Two. | One inch from bladder. | Died. | Died of heart failure in thirty- six hours. |
| 14. | Israel. | Male. | 31 | Right. | Colic. Haematuria. | One. | Juxtavesical. | Died. | Nephrectomy followed by ureter- ectomy. Ureter ligated at blad- der entrance and removed. |
| 15. | Israel. | Male. | 33 | Left. | Pain in left kidney. | One, 3 cm. in di- ameter; 17 cm. long. | Filling entire ureter. | Recovery. | Nephrectomy for pyonephrosis followed by total ureterectomy. Ureterotomy for pyonephrosis followed by total ureterectomy. |
| 16. | Israel. | Male. | ... | Left. | Colic. Continuous pain in base of bladder, and con- stant desire to urinate. | Three. | Pelvic ureter. | Recovery. | Bladder incised through same wound and stricture at lower end of ureter incised. Su- tured. |
| 17. | Young. | Male. | 33 | Left. | Colic. Continuous pain in base of bladder, and con- stant desire to urinate. | One. | Juxtavesical. | Recovery. | Bladder incised through same wound and stricture at lower end of ureter incised. Su- tured. |
| 18. | Young. | Male. | 29 | Left. | Colic. Continuous pain in base of bladder, and con- stant desire to urinate. | One. | Juxtavesical. | Recovery. | Bladder incised through same wound and stricture at lower end of ureter incised. Su- tured. |
| 19. | Young. | Male. | 25 | Right. | Colic. Pain in bladder. | One. | One inch above bladder. | Recovery. | Sutured. |
| 20. | Barling. | Male. | 20 | Left. | Lumbar pain. Vom- iting. Haematu- ria. | One. | One inch above bladder. | Recovery. | Ureter studded with calcium ox- alate. Sutured. |
| 21. | Barling. | Male. | 33 | Left. | Colic. | One. | Three inches be- low pelvic brim. | Recovery. | Stone removed from urethra in childhood. Sutured. |
| 22. | Fowler. | Male. | 36 | Right. | Colic. Symptoms of vesical calculus. | One. | One inch above bladder. | Recovery. | Sutured. No leakage from ure- teral wound. |
| 23. | Fowler. | Male. | 32 | Right. | Colic with haema- turia. Frequency of micturition marked. | One. | One inch above bladder. | Recovery. | Sutured. No leakage from ure- teral wound. |

(A) Intrarectal. (B) Prerectal. (C) Catheter cystoscopy. (D) Lithotritie. (E) Transperitoneal. (F) Suprapubic cystostomy. (G) Iliac extraperitoneal.